

# Evolution, Scope, and Current Applications of the Precautionary Approach in Fisheries

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**Abstract.** - Overexploitation of natural fish stocks is a global and growing problem despite substantive advances in the disciplines of fisheries science and management. The problem has been well-understood by many professionals for several decades, but it is only in this decade that it has received widespread public recognition and reaction. In the 1990s, several international conferences and agreements embodying the essential need for precautionary approaches to fisheries have been initiated and concluded, primarily by the United Nations. The scope of the precautionary approach is extremely broad. It applies at all levels of fisheries systems: development planning, management, research, technology development and transfer, legal and institutional frameworks, fish capture and processing, fisheries enhancement, and aquaculture (FAO 1996). Current applications and discussions have for the most part focused on specifying, estimating, and applying target and limit biological reference points. Although this is an important and crucial component of the precautionary approach, it needs to be put in the context of a systems approach incorporating many other relevant features. Some fisheries organizations and management agencies have already made progress defining and implementing multifaceted precautionary approaches, but in most cases marked changes in institutions, management procedures, and expectations need to occur before precautionary approaches can be fully embraced.

## Introduction

This paper gives a brief introduction to the history of development of the precautionary approach in fisheries, the overall scope of the precautionary approach with reference to the role of biological reference points and harvest control rules, and the approaches taken by fisheries organizations that are currently adapting or further developing precautionary approaches for their own use. We conclude with some thoughts on the prospect that truly precautionary approaches will ever be fully adopted as the norm in fisheries management.

## Precautionary Approach vs. Precautionary Principle

The Precautionary Principle refers to a "hard line" rule originally conceptualized as a means of managing highly polluting activities. The aim was to control pollution at source even in the absence of scientific evidence proving a causal link between emissions and environmental effects. The Precautionary Principle guards against the possibility of making irreversible mistakes through ignorance. In several instances, the Precautionary Principle has been applied in an extreme form, resulting in a complete prohibition of a particular type of industry or technology (e.g. large-scale high seas driftnet fishing). This has resulted in a reluctance to embrace the Precautionary Principle in fisheries management where most mistakes have high probability of being reversible. Thus, the precautionary *approach* was created as a somewhat more flexible alternative that incorporates socio-economic considerations along with the essential requirement of promoting the long-term sustainability of natural resources.

## Evolution

The United Nations Convention on the Law of the Sea (1982) provided an overall framework and mechanisms to promote responsible management of marine fisheries. However, it was not until the 1990s that work began in earnest to develop a precautionary approach to fisheries management. In 1991, the 19th Session of the Committee on Fisheries (COFI) of the Food and Agriculture Organization (FAO) of the United Nations requested that FAO develop an International Code of Conduct for Fisheries. Subsequently, FAO and the Mexican government sponsored an International Conference on Responsible Fishing, held in Cancun, Mexico in May 1992. Declarations formulated in Cancun were presented at the United Nations Conference on Environment and Development (UNCED) in Rio in June 1992. The Rio meeting highlighted the importance of the precautionary approach in the Rio Declaration and Agenda 21. For example, Principle 15 of the Rio Declaration states that:

*"in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation"*

## FAO International Code of Conduct for Responsible Fisheries

Several binding and non-binding agreements em-

bodying the precautionary approach were developed and concluded over the period 1991-1996. The most comprehensive of these is the FAO International Code of Conduct, adopted by FAO Conference in October 1995 (FAO 1995). The Code of Conduct addresses six key themes: fisheries management, fishing operations, aquaculture development, integration of fisheries into coastal area management, post-harvest practices and trade, and fisheries research. In total, there are 19 general principles and 210 standards in the Code. While a precautionary approach is integral to all themes, it is applied particularly to fisheries management, as detailed in Article 7.5. Paragraph 7.5.1 includes a broad statement to the effect that:

*“States should apply the precautionary approach widely to conservation, management, and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment”.*

The same paragraph also emphasizes that the absence of adequate scientific information is not a reason for failing to take appropriate conservation and management measures. The remaining paragraphs include similar provisions to those in Article 6 of the Straddling Stocks Agreement (see below); for example, determination of stock-specific target and limit reference points, together with action to be taken if they are exceeded, and the need to take account of uncertainties and impacts on non-target and associated or dependent species. In addition, guidelines are given for adopting a cautious approach in the case of new or exploratory fisheries, and for implementing emergency management measures when resources are seriously threatened due to environmental factors or fishing activity.

The Code of Conduct is a voluntary, non-binding agreement. However, it contains sections that are similar to those in two recently concluded binding agreements: the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (the Compliance Agreement) and the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (officially abbreviated as the UN Implementing Agreement, or UNIA, but commonly referred to as the Straddling Stocks Agreement).

#### Compliance Agreement

An FAO Technical Consultation on High Seas Fishing was held in September 1992 and the Compliance Agreement was adopted by FAO Conference in November 1993. The Compliance Agreement specifies the ob-

ligations of Parties whose fishing vessels fish on the high seas, including the obligation to ensure that such vessels do not undermine international fishery conservation and management measures. The Compliance Agreement is considered to be an integral part of the Code of Conduct, as specified in a resolution to this effect adopted by the 1993 FAO Conference. The United States implemented the Compliance Agreement through the High Seas Fishing Vessel Compliance Act of 1995.

#### Straddling Stocks Agreement

The Straddling Stocks Agreement was negotiated over a similar period to the Code of Conduct and the content and wording on many issues, including those related to the precautionary approach and General Principles, is similar between the two Agreements. Although the Straddling Stocks Agreement is strictly only applicable to straddling fish stocks and highly migratory fish stocks, much of it is also relevant to fishing within national exclusive economic zones. The Straddling Stocks Agreement will almost certainly require international organizations to adopt strict overfishing criteria, if ratified.

The Straddling Stocks Agreement describes the “precautionary approach” in Article 6 and Annex II. Article 6 requires application of the guidelines set out in Annex II; determination of stock-specific reference points and action to be taken if they are exceeded; use of the best available scientific information; implementation of improved techniques for dealing with risk and uncertainty; account of uncertainties and impacts on non-target and associated or dependent species; and development of appropriate data collection, research, and monitoring programs.

Annex II of the Straddling Stocks Agreement provides guidelines for the application of precautionary reference points. Paragraph 2 states, “Two types of precautionary reference points should be used: conservation, or limit, reference points and management, or target, reference points.” Paragraph 5 stipulates, “Fishery management strategies shall ensure that the risk of exceeding limit reference points is very low,” and imposes the further constraint that target reference points should not be exceeded on average. Paragraph 7 states that “The fishing mortality rate which generates maximum sustainable yield should be regarded as a minimum standard for limit reference points.” This combination of requirements implies that fishing mortality should always be well below the level associated with maximum sustainable yield ( $F_{MSY}$ ). Such a requirement is a profound and significant departure from typical fisheries management practice, where  $F_{MSY}$  is usually treated as a target (and usually exceeded) rather than a limit.

## FAO Technical Guidelines on the Precautionary Approach

As part of the process of developing the FAO International Code of Conduct for Responsible Fisheries, FAO was requested to elaborate technical guidelines in support of implementation of the Code. Accordingly, FAO and the Government of Sweden held a Technical Consultation and produced guidelines on the Precautionary Approach to Capture Fisheries and Species Introductions in June 1995. These guidelines were initially published by FAO in 1995, then reproduced with minor editing as part of a new series on "FAO Technical Guidelines for Responsible Fisheries" in 1996. They include sections on fisheries management, fisheries research, fishing technology and species introductions. The first three of these are considered in detail in the next section of this report.

More detailed treatments of the historical development of the precautionary approach are contained in ICES (1997), Serchuk et al. (1997), and Thompson and Mace (1997).

### **Scope of the Precautionary Approach**

How important are biological reference points (BRPs) and harvest control rules in the overall context of the precautionary approach?

As mentioned above, the 1995 International Code of Conduct (FAO 1995) addresses several general principles and six key themes:

- Fisheries Management
- Fishing Operations
- Aquaculture Development
- Integration of Fisheries into Coastal Area Management
- Post-Harvest Practices and Trade
- Fisheries Research

According to FAO (1996), precaution is required at all levels; for example, in development planning, management, research, technology development and transfer, legal and institutional frameworks, fish capture and processing, fisheries enhancement, and aquaculture. Thus the precautionary approach is multi-faceted and broad in scope.

The FAO Technical Guidelines on the Precautionary Approach (FAO 1996) groups guidelines on the precautionary approach into three primary subject areas of relevance to capture fisheries: fisheries management, fisheries research, and fisheries technology. The next three subsections summarize the main issues covered under each area and, while they do not include every

aspect of the guidelines, they highlight the large number and diversity of issues involved.

### Fisheries Management

The precautionary approach to fisheries management requires:

- prudent foresight;
- inclusion of precaution in all stages of the management process, from planning through implementation;
- taking account of unknown uncertainty by being more conservative;
- establishment of legal or social frameworks for all fisheries including rules to control access, data reporting requirements, and management planning processes;
- implementation of interim measures that safeguard resources until fisheries management plans are developed;
- avoidance of undesirable or unacceptable outcomes such as overexploitation of resources, overdevelopment of harvesting capacity, loss of biodiversity, major physical disturbances of sensitive biotopes, and social or economic dislocations;
- explicit specification of management objectives including operational targets and constraints;
- extensive consultation to ensure broad acceptance;
- prospective evaluation; and
- sound procedures for implementation, monitoring and enforcement.

### Fisheries Research

In keeping with the precautionary approach, research should strive to:

- provide data and analyses of relevance to fisheries management;
- emphasize the roles that fisheries scientists and others must play in helping managers develop objectives;
- provide scientific evaluation of consequences of management actions;
- develop operational targets, constraints and criteria that are both scientifically usable and have management relevance;
- conduct both biological and socio-economic research;
- ensure that data are accurate and complete;
- monitor fisheries;
- conduct research on which management processes and decision structures work best;
- incorporate uncertainty into assessments and management;

- conduct research on reversibility in ecosystems;
- formulate implementation guidelines;
- promote multi-disciplinary research, including social, economic and environmental sciences, and research on management institutions and decision-making processes; and
- conduct research into environmentally-friendly fishing gears.

### Fisheries Technology

A precautionary approach to fisheries technology would:

- not use technology to further increase capacity in already overcapitalized fisheries;
- use technology to improve sustainability, prevent damage to the environment, improve economic and social benefits, and improve safety;
- evaluate the effects of new technologies and gears;
- educate fishers and consumers towards responsible practices;
- consider impacts on non-target species and ecosystems;
- evaluate fishing gears with respect to selectivity by size and species, survival of escapees, ghost fishing, effects on habitat, contamination, pollution, generation of debris, safety and occupational hazards, user conflicts, employment, monitoring and enforcement costs, techno-economic factors (infrastructure and service requirements, product quality), and legal factors (existing legislation, international agreements, civil liberties);
- consider proper procedures for introducing new technology or changes to existing technology;
- promote research to encourage improvement of existing technologies and to encourage development of appropriate new technologies;
- ensure proponents and other stakeholders understand obligations and rights; and
- encourage research into responsible fisheries technology.

### The Role of BRPs and Harvest Control Rules

From these three lists, it is obvious that biological reference points and harvest control rules are but one small part in the overall framework of the precautionary approach. In fact, BRPs are not mentioned at all in the summary section of the FAO Technical Guidelines on the Precautionary Approach (FAO 1996). Although they can be considered a central feature of any precautionary management strategy, biological reference points need to be put in proper perspective. Other needs may be just as important; for example, development of access control systems to ensure that fishing capacity is

commensurate with resource productivity, evaluation of alternative management systems and institutions, improvements in the quality and reliability of input data, improved monitoring and enforcement, design of “environmentally-friendly” fishing gear, and education of fishers and consumers.

As it happens, there is more work going into the development of new biological reference points and associated harvest control rules than into any of the other areas listed above. For many fisheries scientists, the term precautionary approach has almost become synonymous with setting a conservative upper bound on allowable fishing mortality. Yet there is a long history of devising biological reference points and incorporating them into management advice. Examples of biological reference points that have been proposed in the past include  $F_{MSY}$ ,  $MSY$ ,  $B_{MSY}$ ,  $F_{max}$ ,  $F_{0.1}$ ,  $2/3F_{MSY}$ ,  $F_{med}$ ,  $F_{high}$ ,  $F_{low}$ ,  $F_{\tau}$ ,  $F_{20\%}$ ,  $F_{35\%}$ ,  $MBAL$ ,  $F_{loss}$  (see Gabriel and Mace, this volume, for descriptions of these reference points). Add to this the new reference points proposed by ICES and NAFO summarized later in this paper; viz.  $F_{lim}$ ,  $F_{buf}$ ,  $F_{PA}$ ,  $B_{lim}$ ,  $B_{buf}$ , and  $B_{PA}$ . One might ask whether adding progressively more biological reference points is likely to ensure that scientific advice will be taken more seriously. It should be noted that even though the concept of MSY has existed for several decades and many fisheries management plans explicitly identify MSY as the objective, in reality there are very few fisheries for which fishing mortality has been maintained near or below the level associated with MSY. It appears that as the list of biological reference points has lengthened, and as assessment scientists’ advice has become progressively more risk-averse, average global fishing mortality has increased.

### Putting Precaution in its Proper Place

In the authors’ opinion, the FAO Technical Guidelines to the Precautionary Approach (FAO 1996) over-use the word “precautionary”. The Guidelines refer to “precautionary research”, “precautionary monitoring” of fishing, and a “precautionary system of enforcement”, when what is really meant is relevant and informative research, and effective monitoring and enforcement. More misleading is the reference to “precautionary assessments” of stock status (paragraph 66, FAO 1996). The authors believe that terms like “precautionary assessments” and “precautionary science” should be avoided, and “precautionary” should generally be used only as an adjective describing “management”.

### Precautionary management supported by best available science

It is important that the term “precautionary” be applied in the proper context. In particular, care should be

taken when using the term in relation to the science used to support advice to managers. It is perfectly reasonable for a manager to select a “precautionary” management target (e.g.  $F = 75\% F_{MSY}$  or  $F =$  lower 80% CI of the probability distribution for  $F_{MSY}$ ) based on advice from scientists, but it is not reasonable for scientists to add extra (non-transparent) conservatism or precaution into the estimation process by, for example, calculating a lower CI for a particular BRP and presenting it as the best estimate of that BRP (e.g. claiming that the lower 80% CI of the distribution of  $F_{MSY}$  is the best estimate of  $F_{MSY}$ ). Thus, the “precautionary approach” should be restricted to the *selection* of biological reference points or fishing targets on which to base management advice, not to the *estimation* of those reference points and targets. Similarly, estimates of assessment-related quantities (e.g.  $M$ , growth rates, selectivity patterns and maturity ogives) should be “best estimates”, not “precautionary estimates”, and decisions made in stock assessments regarding model choice and estimation techniques should be based on scientific and statistical arguments, not on which model has the most precautionary interpretation (e.g. the choice between two different theoretical curves fit to stock-recruitment data).

There are already many instances where members of the fishing industry have argued that stock assessment results are deliberately biased low, and that there is therefore no harm in postponing restrictive management actions. It is appropriate (and necessary) for scientists to provide precautionary management advice, but such advice must be based on the “best” assessment, not a conservative assessment; otherwise the advice may not be taken seriously. In addition, precautionary elements of the management advice must be transparent and clearly understood.

### Current Applications

There are at least three international organizations that can be said to have already adopted “precautionary” management procedures, even though that particular term may not have been in vogue at the time: the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), the International Pacific Halibut Commission (IPHC), and the International Whaling Commission (IWC). Two other international organizations have recently been actively developing new biological reference points and harvest control rules that embody the precautionary approach; namely, the International Council for the Exploration of the Sea (ICES) and the Northwest Atlantic Fisheries Organization (NAFO). The North Atlantic Salmon Conservation Organization (NASCO) and the International Commission for the Conservation of Atlantic Tunas (ICCAT) have both recently set up special committees to examine the implications of the precautionary approach. In

addition, at least two new organizations have pledged to adopt the precautionary approach and uphold other requirements of the Straddling Stocks Agreement (an organization covering highly migratory species in the western and central Pacific, based on the Majuro Declaration; and the Southeast Atlantic Fisheries Organization, SEAFO). Details follow.

### Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR)

CCAMLR, which entered into force in 1982, has one of the longest histories of defining and implementing precautionary approaches, although they may not have been explicitly labeled as such. Most importantly, CCAMLR was the first international convention to explicitly attempt to specify and implement an ecosystem approach to fisheries management, acknowledging the needs of predators (e.g., whales, seals and birds) and the role of certain prey species (e.g., Antarctic krill) as a critical forage base. According to the Convention, harvesting and associated activities must be conducted so as to (1) prevent any harvested populations from falling below the level that ensures the greatest net annual increment, (2) maintain the ecological relationships between harvested, dependent and related populations of Antarctic marine living resources and restore depleted populations, and (3) prevent or minimize the risk of changes in the marine ecosystem that are not potentially reversible over two to three decades. By any measure, these objectives have strong precautionary aspects, although the term “precautionary” does not appear specifically (Kirkwood and Smith 1995).

From the beginning, CCAMLR took a strong precautionary approach by prohibiting all directed fisheries on several severely depleted stocks of demersal finfish and setting restrictive catch limits for most other exploited stocks. There are currently detailed rules in place for new and exploratory fisheries. For example, at a recent meeting of the Commission, it was agreed that exploratory fishing on Antarctic toothfish must cease if catches reach levels sufficient to demonstrate commercial potential, at which time a detailed evaluation would need to be conducted before further fishing could be authorized. However, there are also obstacles to full implementation of a precautionary approach in the CCAMLR arena. For example, there are no guidelines to ensure that resumption of harvests in fisheries previously closed for the purpose of rebuilding depleted stocks does not again result in overfishing. There is also no mechanism to prevent fishing on stocks for which TACs have not been set. In addition, the Commission is a consensus body, with any one member having veto power, and this can sometimes make it difficult to get strong conservation actions accepted.

### International Pacific Halibut Commission (IPHC)

Of all international fisheries commissions, the IPHC can be said to have had the longest run of successful management (at least from a conservation perspective, though until recently both the U.S. and Canadian fisheries have been characterized by too many vessels and too few fishing days). The stock has never collapsed and is still providing higher than average yields. Several elements of the precautionary approach are evident in the strategies adopted by the Commission. Maintaining a large spawning biomass has taken precedence over maximizing productivity (McCaughran 1996). Remarkably, the IPHC has set conservative quotas in the face of uncertainty, has not let short-term economic concerns influence decisions, and has not been subject to political interference (McCaughran 1996).

### International Whaling Commission (IWC)

The revised management procedure of the IWC, developed during the late 1980s and early 1990s, did not explicitly consider a precautionary approach, yet the procedure ultimately adopted was one that was both precautionary by design and precautionary in performance (Kirkwood and Smith 1995). The first step was the identification and quantification of the IWC's management objectives. Next, simulation trials of management procedures were conducted and the performance of the procedures in meeting management objectives was evaluated statistically. The two key features of the process adopted by the IWC were that all elements of the management strategy were tested simultaneously and that robustness was examined to a much wider range of uncertainties than is normally considered (Kirkwood and Smith 1995).

### International Council for the Exploration of the Sea (ICES)

ICES is in the process of developing and implementing the precautionary approach as part of its standard fisheries management advice. A comprehensive report has been developed by a study group (ICES 1997) and another is underway, based on a meeting in February 1998.

Whereas Annex II of the Straddling Stocks Agreement suggests use of  $F_{MSY}$  as the limit reference point, the ICES study group advised setting the limit reference point ( $F_{lim}$ ) equal to a conservative estimate of  $F_{crash}$ , the fishing mortality corresponding to the tangent through the origin of a stock-recruitment relationship (referred to as  $F_{extinction}$  or  $F_{\tau}$  by Mace and Sissenwine (1993) and Mace (1994)), or a related quantity. While this may seem a rather risky reference point, the study group then suggested that the precautionary fishing mortality should

be expressed as  $F_{PA} = F_{lim} e^{-2\sigma}$ , where  $\sigma$  should take into account several sources of variation and error. If  $\sigma$  is as high as 0.35,  $F_{PA}$  will be about half of  $F_{lim}$ . For some stocks, this may result in  $F_{PA}$  levels quite close to the point estimate of  $F_{MSY}$  (e.g., Mace (1994) showed that point estimates of  $F_{MSY}$  could be up to 43% of point estimates of  $F_{\tau}$  for certain life history parameter combinations in deterministic, age-structured fishery models). The ICES study group also defined  $B_{lim}$  as a biomass limit below which the stock is in imminent danger. As with precautionary fishing mortality rates, a precautionary biomass level should be defined based on  $B_{lim}$  as modified by some margin of safety.

The ICES study group met for the second time in February 1998 and further developed methods and guidelines for estimating these and related reference points, and provided preliminary estimates of precautionary reference points for most ICES stocks.

### Northwest Atlantic Fisheries Organization (NAFO)

The approach currently under discussion by NAFO (see for example Serchuk *et al.* 1997) bears considerable resemblance to the ICES approach, with one key difference. NAFO appears to have accepted the literal interpretation of paragraph 7 of Annex II of the Straddling Stocks Agreement, and set  $F_{lim} = F_{MSY}$  rather than a quantity related to  $F_{extinction}$  ( $F_{\tau}$ ). Serchuk *et al.* (1997) further define a term,  $F_{buf}$  as "a fishing mortality rate below  $F_{lim}$  that acts as a buffer to ensure that there is a high probability that  $F_{lim}$  is not reached. As such, on average,  $F_{buf}$  should not be exceeded. The more uncertain the estimate of  $F_{lim}$ , the lower the value of  $F_{buf}$ , and the greater the distance between  $F_{lim}$  and  $F_{buf}$ ".  $F_{target}$ , a fishing mortality level based on management objectives, is defined to be a level below or equal to  $F_{buf}$ . Similarly,  $B_{lim}$  is defined as a "level the spawning stock biomass should not be allowed to fall below", and  $B_{buf}$  is "a level of spawning stock biomass, above  $B_{lim}$ , that acts as a buffer to ensure that there is a high probability that  $B_{lim}$  is not reached". In addition, for depleted stocks,  $B_{tr}$  is defined as the target total stock biomass recovery level that would produce maximum sustainable yield.

In March 1998, NAFO conducted a workshop to review the implications of this and other approaches (including the approaches reviewed or developed by ICES), and to begin attempting to apply them to NAFO stocks (NAFO 1998).

### North Atlantic Salmon Conservation Organization (NASCO)

A meeting of the Working Group on the Precautionary Approach in North Atlantic Salmon Management was held in Brussels, Belgium in January 1998.

The Working Group recommended that “NASCO and its Contracting Parties should apply the Precautionary Approach widely and consistently to the conservation, management and exploitation of salmon in order to protect the resource and preserve the environments in which it lives...”, with subsidiary recommendations echoing the language of the FAO Technical Guidelines on the Precautionary Approach to Capture Fisheries and the Straddling Stocks Agreement. The Working Group agreed that the precautionary approach is not limited in its scope but is a philosophy which would apply generally in order to take into account scientific uncertainty and imperfect management. It was recommended that management measures should be aimed at maintaining all salmon stocks in the NASCO Convention Area above their conservation limit, currently defined by NASCO as the spawning stock level that produces maximum sustainable yield. It is currently unclear whether  $B_{MSY}$  is actually the limit or the target, and if not, exactly how the limit and the target differ.

#### International Commission for the Conservation of Atlantic Tunas (ICCAT)

ICCAT’s management strategy is founded on MSY. In fact, the Convention itself (International Convention for the Conservation of Atlantic Tunas; Rio de Janeiro, 1966) never uses this acronym, does not imply that levels exceeding MSY constitute overfishing, does not use terms such as overfishing and overexploitation, and is not specific about the actual management objectives and how they will be applied. Nevertheless, ICCAT tends to evaluate the status of stocks relative to MSY-based reference points. Typically, ICCAT classifies stocks as “overexploited” when the exploitable biomass falls and stays below  $B_{MSY}$ , the average biomass level associated with MSY. ICCAT also raises concerns about overfishing for some species groups when estimated fishing mortality is well in excess of  $F_{MSY}$ .

In October 1997, ICCAT’s Standing Committee on Research and Statistics (SCRS) agreed to form an ad hoc working group to develop recommendations on the application of the precautionary approach to Atlantic tunas and tuna-like species. The first meeting was held in May 1998.

#### Majuro Declaration

A Multilateral, High-Level Conference (MHLC) on the conservation and management of highly migratory fish stocks in the western and central Pacific was held in Majuro, Republic of the Marshall Islands in June 1997. The conference resulted in the “Majuro Declaration” which states that the entities represented at the conference declare their commitment to establish a mechanism for the conservation and management of highly migra-

tory fish stocks of the region in accordance with the Law of the Sea Convention and the Straddling Stocks Agreement, including wide application of the precautionary approach. The Declaration emphasizes the commitment to adoption of the precautionary approach several times in the text. A workshop on precautionary limit reference points for highly migratory fish stocks in the western and central Pacific Ocean is scheduled to be held in Honolulu in late May, 1998.

#### Southeast Atlantic Fishery Organization (SEAFO)

Another example of a current international initiative that incorporates the precautionary approach is the proposed establishment of the Southeast Atlantic Fishery Organization (SEAFO). SEAFO was proposed in 1997 by the three coastal states, Angola, Namibia, and South Africa, and the United Kingdom (on behalf of St. Helena and its other island dependencies in the area) as an organization which would have management responsibilities for the fish resources (except highly migratory species and cetaceans) in the southeast Atlantic. The draft SEAFO Convention that was distributed and discussed in December 1997 in Windhoek, Namibia, is replete with references to the precautionary approach and precautionary reference points. Equally significant is the fact that the coastal states are urging the creation of SEAFO primarily to manage and conserve a recently discovered and poorly understood handful of high seas or straddling stocks, many of which are believed to have low productivity (e.g. orange roughy, toothfish, alphonsins and armourheads).

#### Other Applications of the Precautionary Approach

The term “precautionary approach” has quickly become an integral part of the vocabulary of fisheries professionals. However, its precise interpretation and operational procedures for its implementation have not yet been formally developed by most governmental and international organizations. The precautionary approach has so many facets that it is possible for fisheries management agencies to claim that they have already adopted the approach, particularly in the case of stocks that have not yet collapsed or are in the process of rebuilding. And almost every reform currently under development can be construed as adhering to one or more components of the precautionary approach. Thus, a comprehensive global overview of attempts at implementing a precautionary approach is not really practical, and perhaps not even useful (see Thompson and Mace 1997 for an early attempt to summarize applications of the precautionary approach on a global basis). Suffice to say that many countries are in the process of integrating the precautionary approach into their national fisheries policies. Those at the forefront include the United States, Canada, New Zealand, Australia, and South Africa.

## Prospects and Prognosis

For most national and international fisheries organizations, implementation of the precautionary approach will radically change both the form of scientific advice and the level of conservatism embodied in that advice. The primary reason is the requirement that  $F_{MSY}$  be used as an upper bound on permissible fishing targets (as implied by the definition of Optimum Yield in the Magnuson-Stevens Act), or a limit to be avoided (as stated in Annex II of the Straddling Stocks Agreement), rather than a frequently-exceeded target. Since fishing mortality rates in many of the world's commercial marine fisheries are already well beyond  $F_{MSY}$ , substantial overall reductions in fishing mortality will be required.

Even if management agencies have sufficient authority and resolution to implement such reduced fishing limits, they will encounter numerous impediments to the full adoption of the precautionary approach in fisheries. The first and most obvious of these is human population growth, particularly in coastal developing nations where food security is becoming an increasingly alarming problem. Pressures of population growth have resulted in increased demand for fish in subsistence fisheries, as well as increased demand for fish imports in some nations, with the latter resulting in an overall increase in exports of fish from developing to developed nations. The net effect is gross overcapacity (both in terms of capital and labor inputs) on a global scale, relative to what natural marine resources are capable of producing on a sustainable basis. The current situation of overcapacity and overdependence on natural marine resources represents a tremendous obstacle to effective fisheries management, particularly when coupled with the lack of political will to confront the problem in most countries. Mace (1996) discussed these issues in detail, along with the related problems of the common mentality that still perceives fishing as the "last frontier", belief in the status quo (the status quo should be retained at all costs; change is bad), oversimplified objective functions, conflicting objectives of user groups, and the propensity for short-term economic gain to win out over long-term sustainability.

Unfortunately, solutions to the overcapacity and overdependence problem generally remain elusive. Development of aquaculture may assist in reducing dependence on natural marine resources, and reduced dependence may alleviate the overcapacity problem. However, to date, most attempts to reduce fleet capacity have been expensive and largely ineffective (the exception being some instances where individual transferable quotas or other forms of property rights systems have been implemented).

A necessary precursor to the adoption of a precau-

tionary approach to fisheries management is an overall change in the mindset of users and consumers alike; expectations of the ability of natural marine resources to provide food and income for current and future generations need to be aligned with reality. On the positive side, there is evidence of growing public awareness of the extent of overfishing, the resultant depletion of the world's fisheries resources, and the need for risk-averse approaches to the exploitation of natural resources. This awareness is being fueled by the growing involvement of the conservation community and growth of the recreational and "ecotourism" sectors. Public awareness may be further elevated by "eco-labelling" projects currently underway, provided these maintain credibility based on sound scientific analysis. There is also a world-wide movement to discourage or abolish government subsidies in a number of different areas, including fisheries. Already, the breakup of formerly heavily-subsidized economies has helped alleviate overfishing in some parts of the world. Ultimately, sustained public involvement and outcry should mobilize the political will needed to fully adopt the precautionary approach.

The scientific community also needs to become more involved. To date, scientists have generally been reluctant to make recommendations on matters that can be construed as "allocation issues". However, in the future, it may be beneficial for scientists to become much more involved in so-called allocation issues; for example, making recommendations on environmentally-friendly vs. destructive fishing gears; highlighting the ills of overcapacity and excess competition and their implications for assessment, management, monitoring and enforcement; and calculating MSY and other reference points on the basis of an "optimum" catch-at-age distribution (and subsequently making recommendations about where, when and how to fish) instead of just going along with the existing partial recruitment pattern.

In many respects, the precautionary approach is simply the newest in a long list of "buzz words" that don't have concise operational definitions, but do have similar management implications. This list includes recent calls for risk-averse management, ecosystem approaches, maintaining biodiversity, maintaining genetic diversity, reducing bycatch, and so forth. The management implications of each of these are simple and straightforward: all imply that fishing mortality must be reduced across the board -- on all species at all trophic levels in all oceans. Ultimately, this is what the precautionary approach will entail.

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